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ABSTRACT

Developed at The Mountain School (Lookout Mountain, Georgia), a project funded under Title III of the Elementary and Secondary Education Act, 1974-75, this curriculum guide for an interdisciplinary minicourse in weaving provides for integration of environmental and career education goals with those in academic areas. Introductory material indicates that a teacher interested but not necessarily experienced in the weaving craft can effectively direct the minicourse and that the program can be enriched by a tour of a textile manufacturing plant and using local weavers, spinners, and vegetable-dyers as teaching assistants at the school or for special activities in artists' studios. The guide contains (1) course concepts (in language arts, mathematics, science, social studies, art, and vocational training), (2) list of objectives, (3) student activities, (4) procedures and physical facilities needed, (5) directions for 20 student activities, (6) weaving vocabulary glossary, (7) a list of weaving-related job opportunities, and (8) a list of suggested resources (books, magazines, films, etc.). (HD)

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Weaving

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by Rubynelle Counts

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INTRODUCTION

The Environmental Quality Education Act of 1970 stated that "Environmental education is the educational process dealing with man's relationship to his natural and manmade surroundings, including the relation of population growth, pollution, resource allocation and depletion, conservation, transportation, technology, and urban and rural planning to the total human environment."

The Title III Mountain School Project has established a priority of environmental education to be used in every possible area of the regular curriculum as well as in mini-courses having an interdisciplinary approach.

One of the original goals of the project is "To utilize the rich mountain environment—natural, cultural, historical and human." This mini-course in weaving deals with these four aspects of the environment. The availability of appropriate natural materials and other resources has led to important textile industry in our area, and the natural beauty has been a factor motivating artists to settle here. The project has been benefitted by the contribution of yarns, the accessibility of grasses and other natural supplies for weaving and participation in activities by interested craftsmen and non-craftsmen from the community. A teacher interested but not necessarily experienced in the weaving craft can effectively direct this mini-course. The program can be enriched by using local weavers, spinners and vegetable-dyers as teaching assistants at the school or for special activities in the artist's own studios. Further enrichment can be achieved by including a guided tour of a local textile manufacturing plant.

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CONCEPTS

Weaving is a natural vehicle for practical instruction in the primary education blocks.

Language Arts
Communication skills are developed as awakened interest in weaving experiences motivates reading, listening, questioning, discussing, reporting orally and making written records.

Mathematics
Mathematical concepts and skills such as measuring, counting and making spatial configurations and logical predictions are automatically involved in weaving.

Science
The textile field commercially makes much use of laboratory testing, and the scientific method has many applications to the handcraft of weaving.

Social Studies
The craft of weaving has paralleled much of man's historical development up to and including today's industrialized society.

Art
Weaving provides design experiences with color, texture, line, space, form, rhythm and expression.

Vocational Training
Construction of delightful, useful objects becomes a medium for instruction in appropriate use of tools and materials, good workmanship practices and the application of specific learned techniques and specific bits of knowledge.

OBJECTIVES

- To provide heightened appreciation for and understanding of the world in which we live, especially for our own community
- To increase understanding and appreciation of man's accomplishments in problem solving resulting in tools, technology and social practices
- To improve group skills
- To increase ability to give and follow instructions
- To improve efficiency and craftsmanship in work
- To expand vocabulary
- To increase effectiveness in reading for understanding
- To improve research facility
- To develop observation skills
- To provide practice in writing exposition, narrative and observation notes
- To awaken appreciation for and improve skill in the use of basic mathematical procedures
- To increase awareness of vocational and avocational opportunities
- To awaken a desire for beauty and experience joy in creation

ACTIVITIES

The student will

- read one hour each day from relevant materials and will summarize his reading in his notebook.
- write a narrative report on the history of weaving.
- construct a model of a primitive loom.
- study basic weaves, diagramming them on graph paper, finding commercially-produced examples and constructing paper samples.
- calculate a warp for yardage.
- design a coat fabric and weave a sample swatch.
- construct a practical loom.
- weave a sample using fabric scraps for weft.
- weave a sample using natural or recycled "found" materials other than yarn or cloth for weft.
- weave a pile rug segment which may be joined with other students' rug pieces to make an area rug or hanging for the school.
- observe different fibers under a microscope and will make drawings of his observations.
- experiment to compare shrinkage patterns of different fibers and will plot his findings on scale graphs.
- conduct a burning experiment to observe the reactions of different fibers to flame and will record his observations.
- perform an absorption test on swatches of different fiber content and will record his findings.
- analyze the elasticity of yarns made from different fibers and will record his findings.
- apply his laboratory findings to practical problems and will write his conclusions.
- observe a studio loom designed for handweaving and/or a power loom used in industry and will identify the essential parts.
- pass a dictated vocabulary test on given weaving terms.
- assemble his worksheets and reports in a notebook.
- produce, depending on available looms, a sampler, an Inkle Loom belt or/and a "spec" case woven on cardboard.

PROCEDURE

Most any classroom can become an effective studio for this weaving mini-course. It will be helpful if the room is furnished with tables and chairs rather than desks. Activity centers should be set up and prominently labelled as a means of organizing work and motivating good craftsmanship in housekeeping as well as in products.

Laboratory
This should be a long table or counter against a wall having an electrical outlet for plugging in microscope and electrical coffeepot for boiling water. A clothesline should be strung over the table where dripping will not be disastrous. Yarns, swatches and other materials to be used for experiments and worksheets should be conveniently located and clearly identified. Excess chairs or supplies must not be allowed.

Library
This may be a relatively quite corner containing a table and chairs. A sturdy cardboard box on the table can hold the reading material (see attached bibliography). A dictionary, notebook paper and a supply of pencils may come in handy.

Design Center
This should be one large, uncluttered smooth-surfaced worktable and another table or counter containing a "permanently" located paper cutter, crayons, masking tape, colored papers, graph paper, rulers, scissors, cardboard and posterboard scraps.

Materials Center
Assorted yarns should be enticingly shelved in the center and other materials appropriately displayed and stored—i.e., a vase of grasses, a ball of torn-cloth strips on the shelf above the box of fabric scraps, a basket of cornshucks, a churn of veneer strips and reeds.

Shop
This is an area with furnishings that will not inhibit sawing, hammering, etc. with appropriate wood scraps, nails and screws conveniently packed, and hammers, saw, square, pliers and sandpaper in a toolbox.

Weaving Area
This is a large, "common" area where students can work on their projects—maybe the center of the room with tables and chairs or desks.

Project Storage
Some provisions must be made for storage of looms and weavings in process. If mat looms of the attached design are to be used, they need to be stored individually on shelves or stacked on end to prevent bending of tacks.

Warp Winding Area
This area and the loom area are needed if the project has access to a studio loom and a warping frame or reel. A warping frame should be hung flat against a wall with space in front of it to set a cone of yarn and to move (two people at the most) while making a warp. A warping reel requires more space, depending on its size.

Loom Area
If a floor loom is to be used, it will be the center of much activity and will require about eight square feet.

Display Area
A bulletin board above a shelf or narrow table can show off samples while models of primitive looms, etc. rest below.

Bulletin Board
Posters giving information about vocation possibilities and interesting data about the textile field and its essential involvement in all areas of life should be provocatively presented. Pictures of weaving activities in other cultures and of local textile operations should be displayed.

A small class (no more than 15 students) will allow the students to accomplish many activities and do them intensively, whereas a larger class can be effective if used more as an introduction to the textile field. This mini-course can become a successful medium for cross-grade grouping; however, with a wide range of ages or abilities, the teacher may feel the need to make individual assignments.

Students in a small class may elect certain activities and reap benefits from observing other projects carried on by their classmates. They may construct their own small looms and have more freedom in scheduling activities. Students may sign up for laboratory and reading periods on time charts posted in the centers. Construction of the looms may be determined by contract.

For a larger class, looms should be constructed before the course begins and might be assigned to students with a deadline set for project completion. Laboratories could be scheduled one or two per day and, except for the microscope observations, could be conducted by the teacher or a student committee on a group rather than individual basis.

Though work with a large floor-model craftsman's loom is exciting and educationally beneficial for students, it is not by any means essential to a successful weaving mini-course. (Much of the world's most beautiful textiles have been woven on frames or even less sophisticated devices.) Using a floor loom does necessitate some weaving expertise on the part of the instructor. Some activities are included in this packet for the floor loom and the warping frame which would not be used if these pieces of equipment are not to be considered. Even if they are available, it is recommended that a large class use more field trips to industry and perhaps to a craftsman's studio plus movies, slides and charts with lecture demonstrations to develop understanding of weaving principles rather than attempt student involvement with a studio loom in such a short period of time. (See attached bibliography.)

Set-up Procedures for Laboratories

It is important that adequate preparation be made for the laboratories to establish a proper atmosphere for improving observation skills and following carefully the scientific procedures. The following suggestions may be helpful.

Microscope Study
A strong microscope with a light is needed. Yarns to be observed should be conveniently placed as should be worksheets and scissors. A chart of clearly identified samples of the yarns will help the student.

Shrinkage Test
A drying line is essential. An electric coffee pot works well for boiling water. A large mixing bowl will hold room temperature water. Nearby, place tongs, paper towels, clothespins and a bath towel for emergency use. In a separate grouping, place worksheets, clearly identified test yarns, scissors, small slips of paper for labels, yardstick and magic markers.

Burning Test
This can be effective outside under controlled conditions. It must be set up away from flammables and dampness. Use a candle secured in a large-based holder and allow no one except the teacher to light it. Precut test yarns, and label them in separate boxes.

Absorption Test
Set up in an uncluttered space where ink spills won't be disastrous. Precut and label swatches by code in separate containers. Use a bottle of washable ink with easily removed cap and a medicine dropper resting in a saucer. Locate tape, notesheets and paper towels in a logical place for emergency use. A checksheet of correctly identified swatches should be available after the student has completed his test.

Elasticity Test
Place labeled yarns in easily usable form, tape-measure, yardstick, scissors and worksheets near an appropriate doorknob or other projection.

General Tip
Hang scissors by a long piece of yarn attached to each work area to get much use out of a few pairs and also to avoid loss of time hunting covered-up scissors.

BACKGROUND INFORMATION ON WEAVING

Primitive Looms

Probably the earliest loom used for weaving cloth consisted of a cloth beam supported across two upright poles. The warp was attached to the beam and held in tension by weights which hung freely. Archeologists and anthropologists believe that the looms referred to in early Greek writings and for which artifacts have been discovered in ruins dating to the Norsemen and Lake Dwellers were of this type.

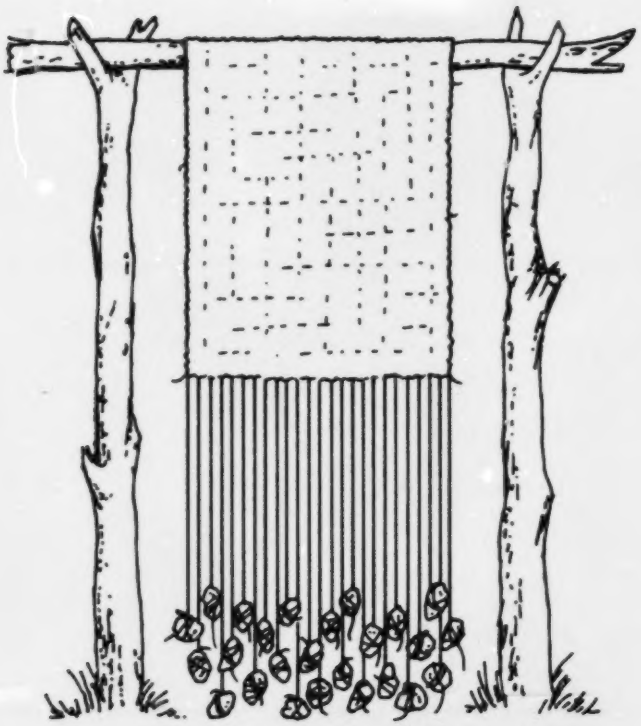
Vertical frame looms have been in use in many cultures since early times. American Navajo Indians still use a frame loom variation for the timetaking production of fine rugs and blankets in interesting geometric patterns. Women weavers in West Africa use frame looms constructed of palm poles lashed together. On these devices, raffia heddle bars are used to yield the many sheds required for complicated patterns.

Whereas Navajo weavers prepare their warp on a separate device and twine it so that selvages will be finished on all sides before lashing it to the loom, Nigerian women wind warp directly on to beams attached to the frame loom. This warp is wound as a tube so that the weaver may pull an unwoven section into a working range that is comfortable to her.

Primitive backstrap looms make use of string heddles attached to separate sticks in a continuous, looped fashion as do the vertical frame looms discussed above. The warp of a backstrap loom may be attached to a convenient tree at one end and to a band that slips around the weaver's waist at the front end. By leaning back, the weaver controls the warp tension. This loom is quite portable.

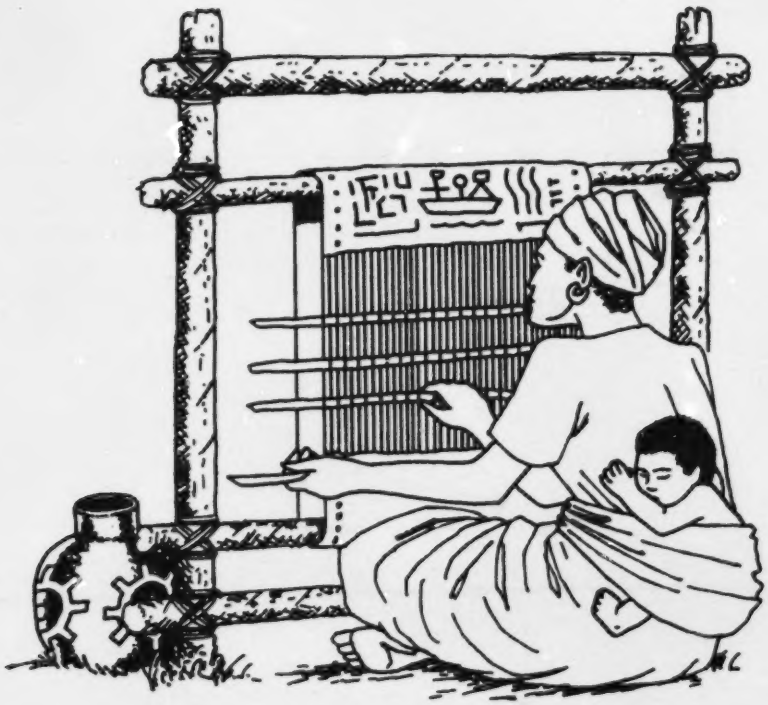
Men weavers in Nigeria also work with portable equipment. A loom for them consists of two short harnesses and some shuttles which may be wrapped easily for transportation or opened for use outdoors in the sunny climate. The harnesses are set up for use by counterbalancing them over a tree branch. The long, narrow warp is threaded through the harnesses and attached to a cloth beam supported by Y-shaped sticks driven into the ground and stretched for tension to its full length and weighted at the far end with a stone.

The study of primitive-type looms is interesting but also practical as it often leads to the learning of techniques and suggests solutions to problems that can be effected with more sophisticated looms.

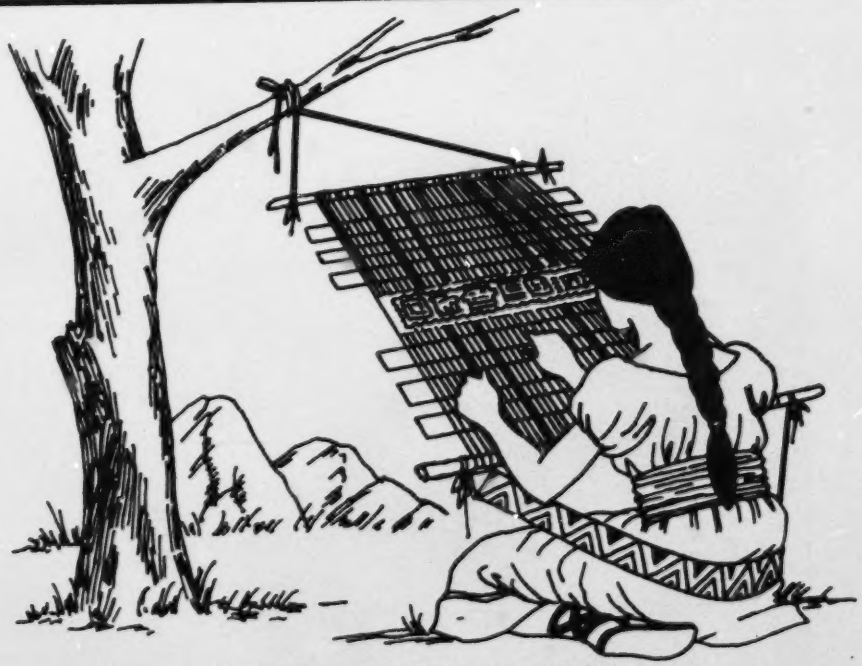


WARP-WEIGHTED LOOM

NAVAJO WEAVING



WEST AFRICAN FRAME LOOM



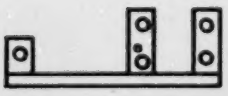
PERUVIAN BACKSTRAP LOOM

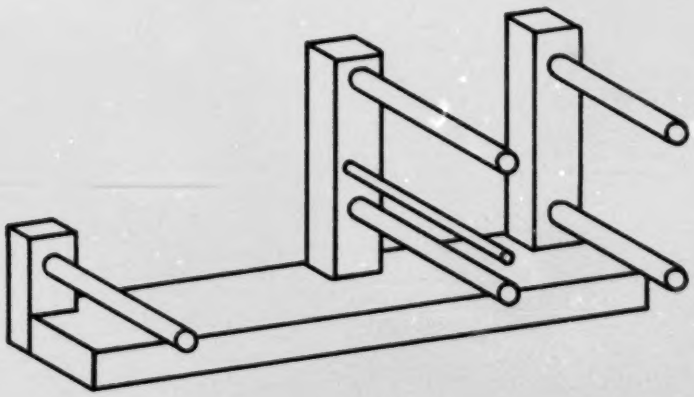
WEST AFRICAN MAN'S LOOM

The Inkle Loom

A practical loom for weaving belts and narrow bands.

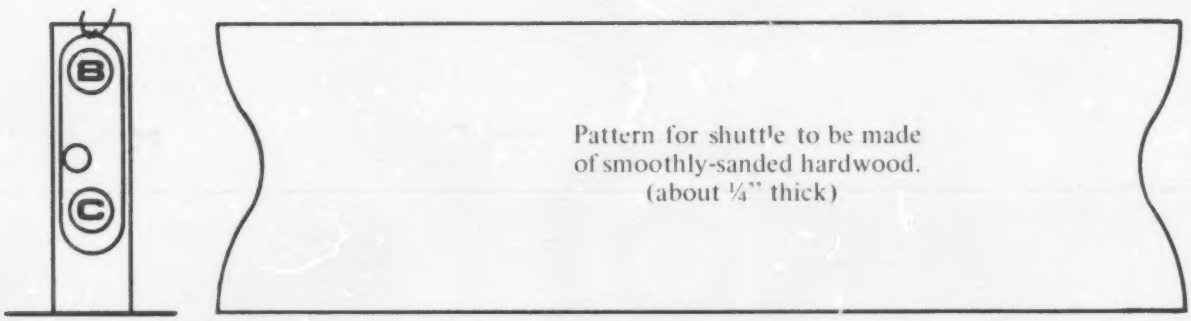
Many varieties of this loom are commercially available, but advanced shop students might make their own out of scrap lumber and broomsticks if a drill, a saw, woodscrews, glue and sandpaper are available.





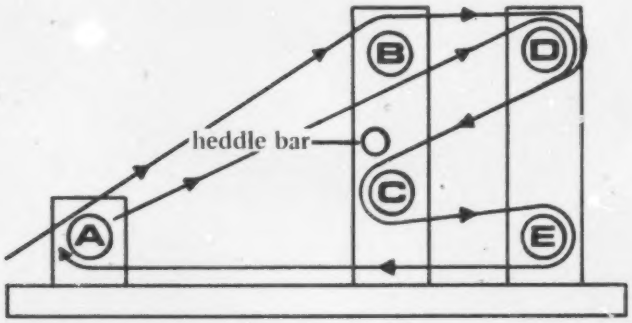
Materials needed

1 2" x 2" x 5" board
2 2" x 2" x 14" boards
1 2" x 4" x 30" board
5 dowels 1" x 8"
1 dowel ¾" x 8'



Pattern for shuttle to be made of smoothly-sanded hardwood. (about ¼" thick)

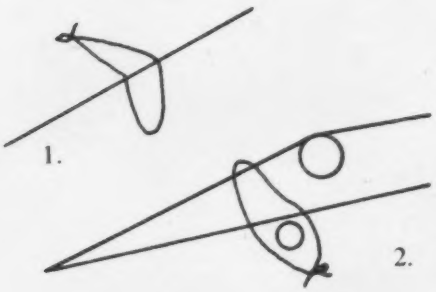
Make 25 heddles by square-knotting loops around B and C pegs using strong string (carpet warp, cotton).



Because of thread heddles attached to the small peg of the Inkle Loom, two sheds are provided to make plain weave easy.

Warp the loom with a continuous wrapping of yarn around the pegs. Alternately pass under Peg B.

Each time the warp is passed over Peg B, it should be caught with a heddle. Enclose the yarn by folding a heddle over it (1) and attaching the two loop ends over the heddle bar (2).



Keep your warp consistently taut, but do not stretch it tight. When you have the desired warp width, cut the yarn and tie the beginning and last ends together. You should be able to slip the entire warp around the pegs by pulling its top toward the front while pulling the bottom toward the back.

To begin weaving you will need to fill your shuttle comfortably full with yarn. Next, find two popsicle sticks or cut two strips of stiff cardboard to use as a base for your weaving.

To weave on the Inkle Loom, push downward on the bottom layer of yarn behind the handles with your right hand. This will clear the first shed. Insert one stick into this shed in front of the heddles and pull it down the warp to a hand's length from the front peg.

Change the shed by using the left hand with thumb hooked around Peg B to pull up the bottom layer of warp so that it is above the heddles, producing a new opening in the warp—the second shed. Insert your other stick in front of the heddles and push it down to the first stick. Check your warp now, arranging the yarns close together on the sticks to cover them. Place a pencil mark on each side of the warp on one of the sticks to make a gauge to help you later on to keep a consistent width.

Get the first shed again and insert your weft yarn through it using your shuttle, leaving a tail of yarn hanging out about one and one-half inches. Wrap this tail around the outside warp thread, then tuck it into the shed.

Get the second shed again and weave the shuttle yarn back through it. Continue weaving through alternate sheds until nearness to the heddles makes the process difficult. At this point, remove the sticks and slip the warp forward in the manner described earlier.

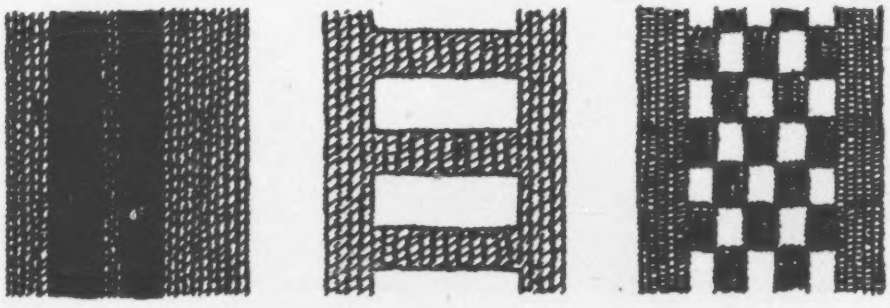
As you weave, take care to maintain a firm fabric with even width and neat edges. Experimentation and practice will help you. Weave until you have about as much warp left as was left unwoven at the beginning. Cut the belt off the loom, leaving equal fringe on both ends.

Patterns on the Inkle Loom may be varied by using different colors, textures and sizes of yarns in the warp. The weaving is *warp-faced,* so the weft yarn shows only at the edges.

By following instructions to this point, you will have made a solid-color belt. Symmetrical and asymmetrical strips can be effective, as can checks and horizontal bars and combinations of these basic patterns. Other patterns require additional sheds and are therefore difficult to produce on this loom.

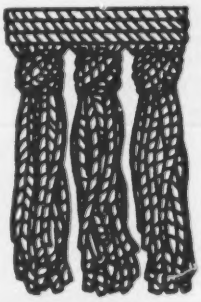
Horizontal bars are made by using one color for the heddled warp and another color for the warp yarns that are not heddled.

To produce checks, use two colors as for bars but reverse them every few yarns.

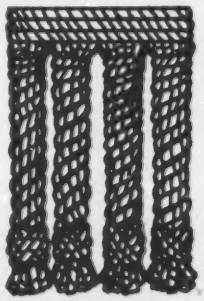


Finishing Weavings

To finish ends of weaving made on the Inkle Loom or by some other process, making knots next to the fabric is the simplest method and produces a handsome tassel or fringe.



A neater finish may be produced by twisting the warp ends into ropes before knotting them. To do this, hold two groups of adjacent warp ends in each hand and twist them simultaneously in the same direction till the yarn starts to kink. Release the two groups together. They will retwist into one firm "rope". Secure the end with a knot.



Mat Loom
(Designed by Rubynelle Counts)

Materials needed
1 plywood rectangular 15" x 24"
114plus ¾" finishing nails
2 flat sticks 1¼" x 17"
hammer
magic marker
ruler

While you are gathering the materials, find *one green, flexible switch 17 inches* long. Scrape it fairly smooth. (The texture and flexibility make this ideal for a heddle bar, though a less satisfactory substitute can be a ¼ inch dowel.)

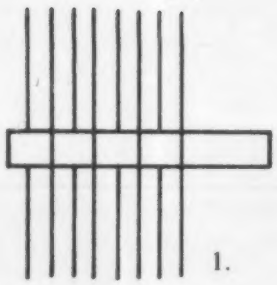
Then cut a *17 inch wire* from a coat hanger and find a strong *cotton string* approximately 95 inches long. A heavy table *fork* and a metal *yarn needle* complete all the ingredients needed for making your loom and weaving on it except for yarns and scissors.

To construct the loom, first mark a guideline ¾ inch from the edge of each narrow side (the top and bottom).

Now mark ¼ inch intervals on the guidelines and hammer a nail at each mark.

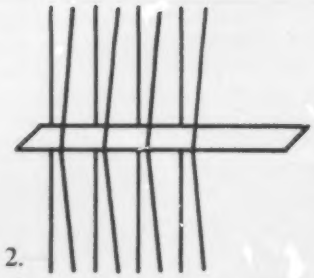
To dress the loom, choose a strong, plied yarn (not too thick) for warp.

Begin with a loop slipped over the first nail in one corner and pass it to the first nail at the opposite corner. Alternately pass from one end to the other, enclosing a different nail with each passage. Continue till all the nails have been used and the board is full of neat warp, vertically, gently stretched. End with a loop over the last nail.



1.

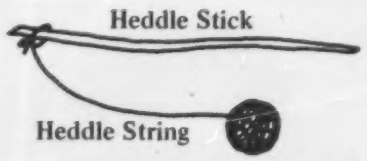
To create a shed, weave one flat stick through the warp so that every other yarn is covered (1). Turn this stick at right angle to the board (2).



2.

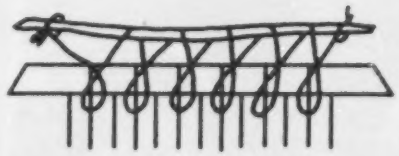
To attach heddles, start by tying a loop in each end of your 95 inch string and slipping one loop over a tip of the heddle stick (switch).

With the left hand, hold the heddle stick parallel to the shed stick woven into the warp with the string attached at the left.



With your right hand, pass the string (balled) under the first raised warp end, going from right to left; then bring it over the top and behind the heddle stick, then down again to enclose the next warp end. Keep a distance of about one inch between your heddle stick and the warp. You can measure by the thickness of your hand.

Repeat this sequence until all raised warp yarns are heddled and slip the final loop over the right end of the heddle stick.



Adjust the heddles by pulling on one loop at a time to use all the heddle string and have relatively even heddles.

To provide for a second shed, weave your other stick into the warp above the heddle stick, picking up the warp ends that were not caught by the heddles. Push this stick to the top of the loom, and you will be ready to begin to weave.

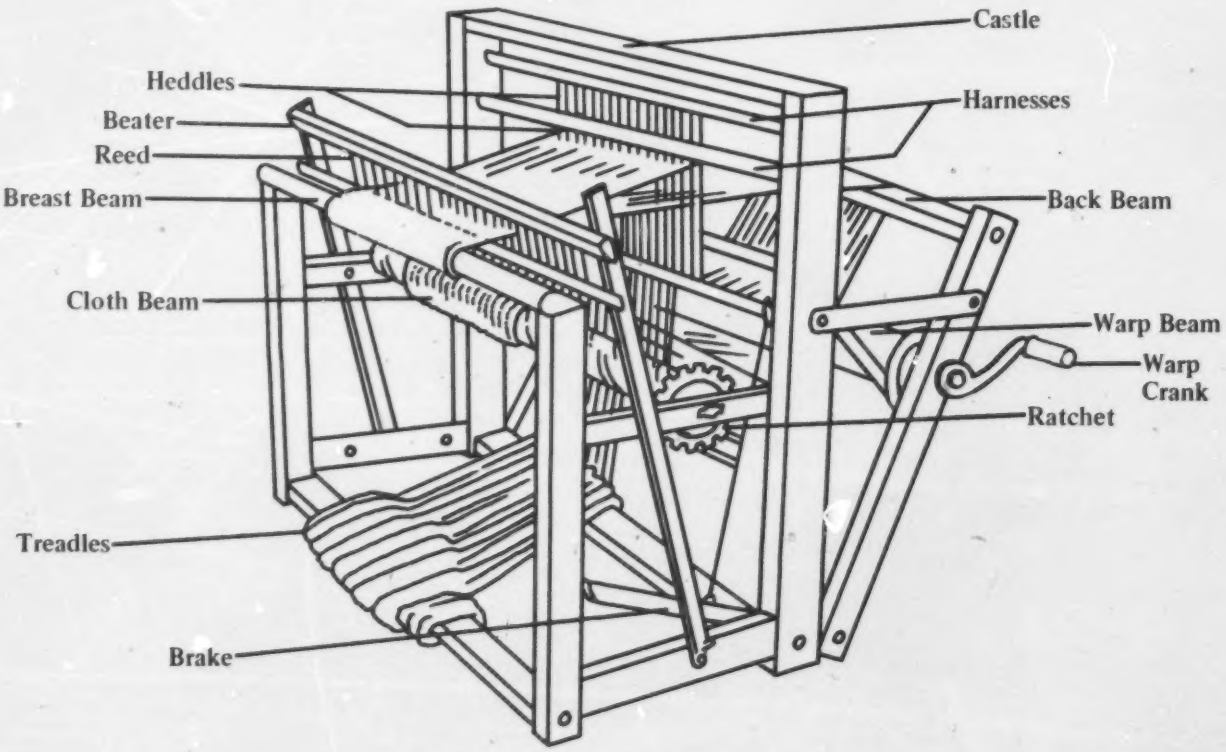
Start weaving by inserting weft in the first shed now held open by heddles and a shed stick. Place the weft in the form of an arc to allow for weaving take-up. Remove the first shed stick and push the weft to the bottom of the loom by beating with your fork with tines pointing downward.

For the second row of weaving, move the shed stick down from the top of the loom to just above the heddles and turn it on edge to open the shed. Insert weft with slack in the form of an arc, turn the

stick flat again and push it back to the top of the loom. Beat the weft into place as before.

Now pick up the heddle stick with your left hand and insert the free stick into the shed this makes. Turn the stick on edge to hold the shed and place your weft. Remove the stick, beat the weft, then bring down the top shed stick, turn it on edge, insert weft, beat, return shed stick, pick up the heddle stick for insertion of free shed stick, etc., repeating the steps till your weaving is completed.

Studio Floor Loom



Lams–(not shown) Levers attached between the treadles and the harnesses to cause harness action when a treadle is pressed.

Apron–(not shown) Cloth (sometimes cords are used instead) which attaches the apron bar (rod for holding warp) to either the warp beam in back or the cloth beam in front.

To begin a weaving project for the floor loom make your warp as suggested in **Warp-Making Activity**, one and one-half yards long, forty ends, from attractive plied yarn.

Dress the loom.

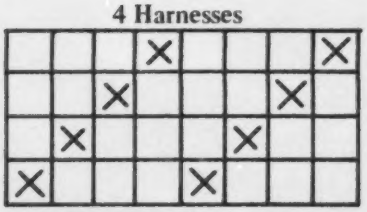
Wind on the warp.

- Slip the cross end of your warp over the apron bar attached to the warp beam.
- Fasten a raddle to the back beam and use it to spread your warp eight ends per inch, centered on the loom.
- Insert shed sticks into the warp to secure the cross, then remove the ties which were used to hold it.
- Divide the heddles and push them to each side of each of the harnesses.
- Pass your warp through the pushed-aside heddles, and move to the front of the loom.
- Take the warp bundle in both hands and give it several yanks or flips while pulling it toward you. Watch the yarns straighten out on the shed sticks as tangles fall out!
- Turn the crank to wind the warp smoothly onto the warp beam. Place a stick or roll of newspaper between each layer of warp as it encircles the beam.
- As you wind the warp, the shed sticks will travel toward the back. Stop turning the crank before they go over the back beam.
- Return to the front of the loom to repeat the warp-flipping activity and move the shed sticks forward as the warp untangles. Sometimes you may have to separate tight tangles at the shed sticks, but do not "comb" the yarn with your fingers as you will be tempted to do, for this will increase tangles.
- Alternate the untangling and winding procedures until only about two feet of warp remains in front of the shed sticks.

Thread the heddles.

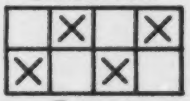
- Clip the looped ends of warp so that each end is made free and even.
- Replace the heddles in their normal harness position.
- Sitting in front of the harnesses, begin at the left side of your warp and thread the first end through a heddle of the rear harness.
- Take each end in sequence as it comes from the shed sticks. Thread the warp through heddles taken in sequence from each harness, one at a time, from back to front.

4 Harnesses



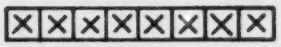
Repeat as Necessary

2 Harnesses

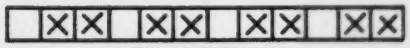


Repeat

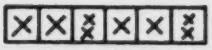
THREADING DRAFT



No. 8 Reed



No. 12 Reed

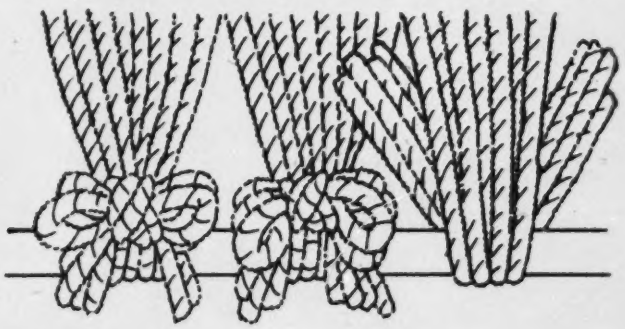


No. 6 Reed

REED DRAFT

- Thread the reed. Determine a threading plan which will spread your warp eight ends per inch in your reed.

- *Tie the warp ends to the apron bar. To do this, pass eight ends (a one-inch reed section) over the rod. Divide the bundle and bring the two parts up the sides of the group to enclose it with a bow-knot.*



Prepare shuttles with weft yarn.

Weave a sampler. Use any or all of these suggestions.

- Experiment with different treadling patterns to find out what the loom can do.
- Weave horizontal stripes of different colors and varying widths.
- Look around you for flexible materials of any kind and try weaving them into your sampler.
- Weave in small inflexible sticks and other "found" objects.
- Make a row of rya knots.
- See if you can produce the basic weaves—plain weave and twill—and make predetermined variations.
- Bunch different textures, colors and sizes of yarn to use together for weft.
- Try weaving inlaid patterns by using an auxiliary weft to color in geometric forms.

Cut your sampler off the loom and finish it as a banner.

- Knot the top warp over a stick or dowel for hanging.
- Finish the bottom by fringe or knotting.

DRAFTING BASIC WEAVES

Weaves are the patterns created in cloth by the way the weft yarns interact with the warp. In order for a designer to explain what a weave will look like, a diagram called a *draft* is made.

The process of diagramming a weave is known as drafting. It uses special paper marked off in squares called graph paper. On a draft, each square represents one warp end. If a square is blacked out, we know that the warp end is covered by weft yarn.

Plain Weave

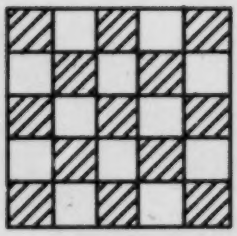
Plain Weave, also called Tabby, is the most basic weave. It is the pattern used for bed linens and most shirt fabrics. In plain weave, the weft yarn passes over one warp end then under the next one, and repeats this sequence across the width of the fabric. In the next row, weft goes over each yarn it went under before and under each end it passed over before. The third row repeats the first, the fourth row repeats the second, etc.

Basket Weave

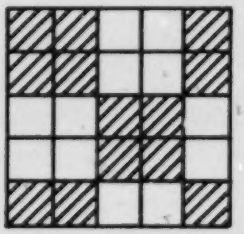
Basket weave is the same as plain weave except that the warp and weft yarns are used in pairs rather than individually.

Twill Weave

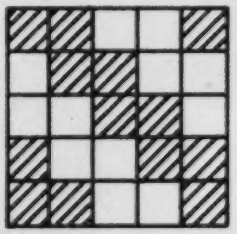
Twill weave, the second basic weave, has a diagonal effect commonly seen in work pants. In it, weft yarn covers alternating warp yarns. The diagonal rib is achieved because each pair of warp yarns picked up by a weft shot includes one of the yarns lifted by the preceding pick.



TWILL WEAVE DRAFT



BASKET WEAVE DRAFT



PLAIN WEAVE DRAFT

Twill Variations

Interesting textures may be produced by simple variations in the basic twill structure. For instance, the well-known herringbone pattern is made by a directional reversal of the twill rib. Less regular textural effects, known technically as broken twills, are achieved by varying the number of warp ends picked up and/or covered by the weft.

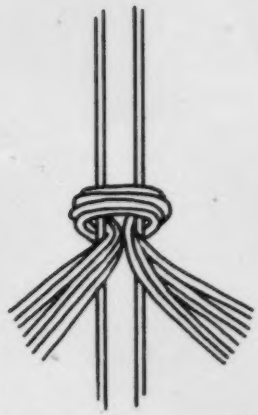
PILE RUG WEAVING–RYA TECHNIQUE

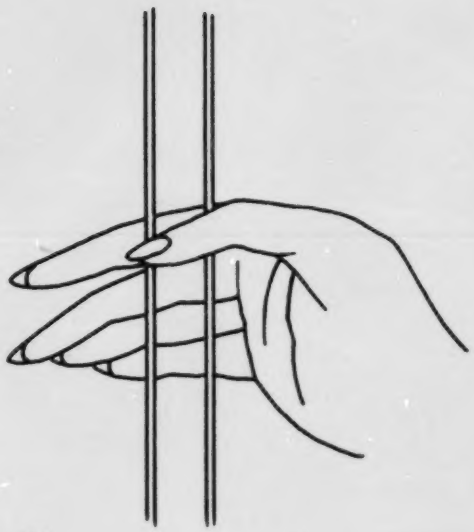
Rya knots may be used to make a soft pile rug.

Pre-cut yarns about 5 inches long.

Use 4 or 6 strands per knot.

To begin, pick up two (or multiples of two) warp ends and hold them separate with a thumb.





Fold the rya group over both warp ends and pull the ends up between them, beneath the loop that is formed.

By pulling the ends tightly together and downward, you can "beat" the knot into place next to the underlying woven weft.

Rows of rya knots are held in a weaving by being alternated with several shots of firmly beaten plain weave.

HOW TO MAKE A STICK SHUTTLE

Choose a relatively straight tree branch about as big around as a pencil and break it off about as long as your loom is wide. Scrape off any twigs.

Attach weft yarn by winding it on top of itself around one end of the stick.

Take this end of the stick loosely between the thumb and fingers and hold it vertically over the ball or cone of weft yarn.

By rotating your wrist, you will allow the yarn to wind itself onto your shuttle. Turn

the stick shuttle end over as often as is needed to achieve a smoothly-filled shuttle.

Do not overfill the shuttle, as too thick a device will not pass easily through the shed in your warp.

Unwind enough weft yarn to complete a pick before you insert the shuttle into your weaving.

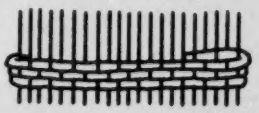
The stick shuttle is a useful primary or auxiliary shuttle for use with any loom. Navajo weavers use stick shuttles for their exquisite rugs and blankets as do women weavers in West Africa in their complicated overshot patterns.

WEAVING PROBLEMS?

What to use for weft?

- One-inch torn strips of scrap cloth can make delightful mats or decorative weavings.
- Grasses make effective hangings, used singly or alternated with appropriate yarns.
- Twisted plastic bag strips can be used.
- Corn shucks, torn into shreads and dampened, have traditionally been used in our Southern mountains for weaving practical, washable mats and rugs.
- Reeds, veneer strips, brown paper bags, etc., can also be used.

What to do when a piece of weft runs out?
Tuck its tail around an outside warp end then back into the shed just used, for clean separation of colors or textures. Otherwise, overlap the old and the new weft pieces about two inches and beat into place.



Does the weft have to be inserted by hand?
It's easier to use just your hand if the pieces of weft are short. For weaving yarn, use a stick shuttle as the Nigerians and some American Indians do. Instructions for a stick shuttle are included in this packet.

What can be done if the warp will no longer make a shed because the weaving has progressed too close to the top of the mat loom?
Ease the problem for a while by substituting the 17 inch wire for a shed stick.

To make selvages on all sides of your mat, weave the last few shots with a yarn needle, continuing right up to the nails.

If you wish fringe on one end of your mat, stop the weaving at any desired point, before the process gets too difficult. Remove the unwoven warp two or four ends at a time and tie them in a flat knot.

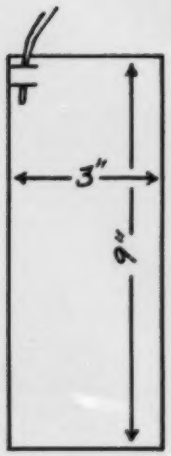
What if the weaving draws in narrower than the base?
This condition results from pulling the weft too tightly. The weaving may be unwoven (tediously), or the work may be announced finished and taken off the loom as a decorative piece!

Any weaving problem is an invitation to explore new possibilities. Learn from the past, carefully follow instructions, but do not be tied to the tried!

STUDENT HANDWEAVING PROJECT

Making a "Spec" Case on Cardboard

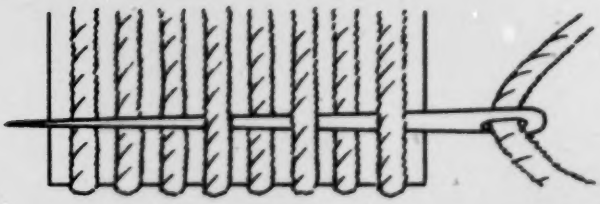
Material needed
1 3" x 9" stiff cardboard (corregations longways)
¾" masking tape
1 yarn needle (metal preferred; a bobby pin will work in a pinch)
Pretty, soft yarn, assorted colors, not too fine in size



To begin, tape a ¾ inch tip of warp yarn 1/8 inch from side of card as shown.

Fill card with vertically wound warp, approximately eight ends to the inch. Keep warp taut but not stretched.

Cut warp and tape final tip to card as at beginning, on opposite side of card. Encircle this end of the card loom with tape to hold warp ends in place.



Fill yarn needle with an arm's length of weft yarn. Weave it through the warp beginning at the untaped end.

Pull the yarn through the warp covering alternate ends, leaving a one inch tail to be caught in later.

Encircle card with weaving, turning it as you get to the edges. Keep weaving slightly lax; don't stretch tight!

Don't worry about specific placement of yarns until you have put five shots. Then use your needle point to space the weaving and push the warp ends to the very sides or place them evenly between; move the weft so that no holes will be left in the weaving at the bottom when it is finished and removed from the card. Your weaving will secure this placement.

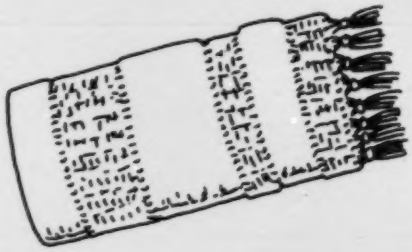
Unless you wish to change colors earlier, weave till your weft yarn runs out. Before rethreading your needle, weave it empty backwards from the starting point. Thread in the dangling warp tail and pull it into the weaving so that it is hidden alongside a weft pick.

When changing yarns, overlap them two inches in the weaving. Clean color breaks can be made by following the procedure given for tucking in the original pick's tail.

Experiment with color and textures of yarn. Find decorative weaving techniques in reference books and try them. The card can be a practical loom for almost any kind of tapestry sample. However, you should keep in mind the function of this assigned weaving and make sure that any technique or material you choose is appropriate for storing eyeglasses.

Weave till your tube measures six and one-half inches. Remove the tape and cut the warp yarns along the top edge of the cardboard. Carefully pull the card out of the weaving, removing tape as you must.

Finish your case by tying a fringe of two adjacent warp ends per overhand knot.



STUDENT ACTIVITIES

Drafting Activity

- Make an attractive notebook page illustrating plain weave. Include a 2" x 2" draft, one or more sample fabric swatches and a 4" x 4" woven paper example.
- Make similar notebook pages illustrating basket weave and twill.
- Make notebook pages illustrating twill variations with drafts and cloth swatches.
- See how many exciting patterns you can create simply by using color variations in plain weave. To do this experiment, weave four-inch squares from paper strips. Mount them on notebook sheets.
- Find interesting weaves in fabric samples and diagram them in 2" x 2" drafts. Use a magnifying glass to help you determine the weave.

Activity for Planning a Warp

Mrs. Jones wants to weave some warm, neatly textured fabric for a winter coat. To cut out the coat pattern she has chosen requires four yards of 45" wide cloth. How much warp should she wind?

To wind her warp just four yards long would result in too little finished yardage because of weaving take-up and loom waste. Therefore, Mrs. Jones must make allowances.

Take-up means the allowance made for the yarn going over and under other yarn during the weaving process. Usually five inches per yard is sufficient.

As a general practice, one yard is added to a warp for *loom allowance.* This provides for the front and back parts of the warp which are attached to the loom and thus cannot be woven.

Yardage required by the coat pattern = _____
Take-up allowance: _____ per yard x desired number of yards = _____
Standard loom allowance = _____
Length of warp wound for Mrs. Jones' coat = _____

How many warp ends are needed to produce 45-inch width yardage? To determine this number, multiply the desired width by the desired density (number of threads per inch. Mrs. Jones' coat should be a fairly tight weave; 10 ends per inch of not-too fine wool will work.)

There is always a difference between the width of the fabric taken off the loom and the warp as threaded in the reed. This difference is known as *draw-in*. Draw-in on wool is usually greater than on cotton, but a three-inch allowance should be adequate.

The required width of Mrs. Jones' fabric = _____
Draw-in allowance = _____
Total required width of warp = _____
Number of ends per inch (density) = _____
Total number of warp ends to be wound = _____

Warp-Making Activity

A warp to be woven on a standard loom must contain the required number of threads held in the proper sequence. There must also be a separation of the yarn into shed layers, this separation being called the *cross*. Each of the ends must, of course, be the desired length, adequate for producing fabric of serviceable length.

Several kinds of devices are available commercially to assist with warp winding. Makeshift arrangements can also prove satisfactory. In Nigeria, weavers wind warps of great length around pegs driven into the ground. Industries use power-driven reels. Many studio craftsmen wind their warps on hand-turned reels. The simplest studio warping device, however, and the one which requires the least space, is the warping frame. It can contain a few or many pegs which can be used optionally, according to the desired length of the warp. It is usually hung flat against a wall.

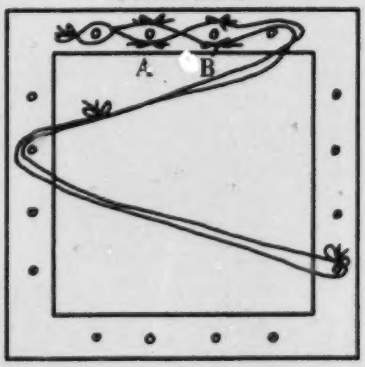
A Warping Frame

The passage of warp yarn down the frame and then back up to the beginning peg makes two warp ends.

The cross is made by taking the yarn over peg A and under peg B each "down trip" and crossing the yarn so that a reverse pattern is made each "up" passage.

When the desired number of ends is wound, tie a small bow (no hard knots) around the entire bunch of warp yarns in the indicated places.

THE CROSS



Wind a warp one and one-half yards long, eight ends per inch, five inches wide to be woven into a sampler on a studio loom.

Weaving a Coat Fabric Sample

1. Choose warp and weft yarns suitable for coat fabric. To get an idea of how they might look woven together, twist them in your fingers and observe how the two different elements combine to make a third new effect.

2. Cut a stiff cardboard into a four-inch by two-inch strip. Mark off a two-inch square in the center; then mark this section in one-eighth inch intervals.

3. Wind your warp yarn around the cardboard, following the marks to maintain the proper density. Tape ends to the back.

4. Thread a yarn needle with one yard of your weft yarn.

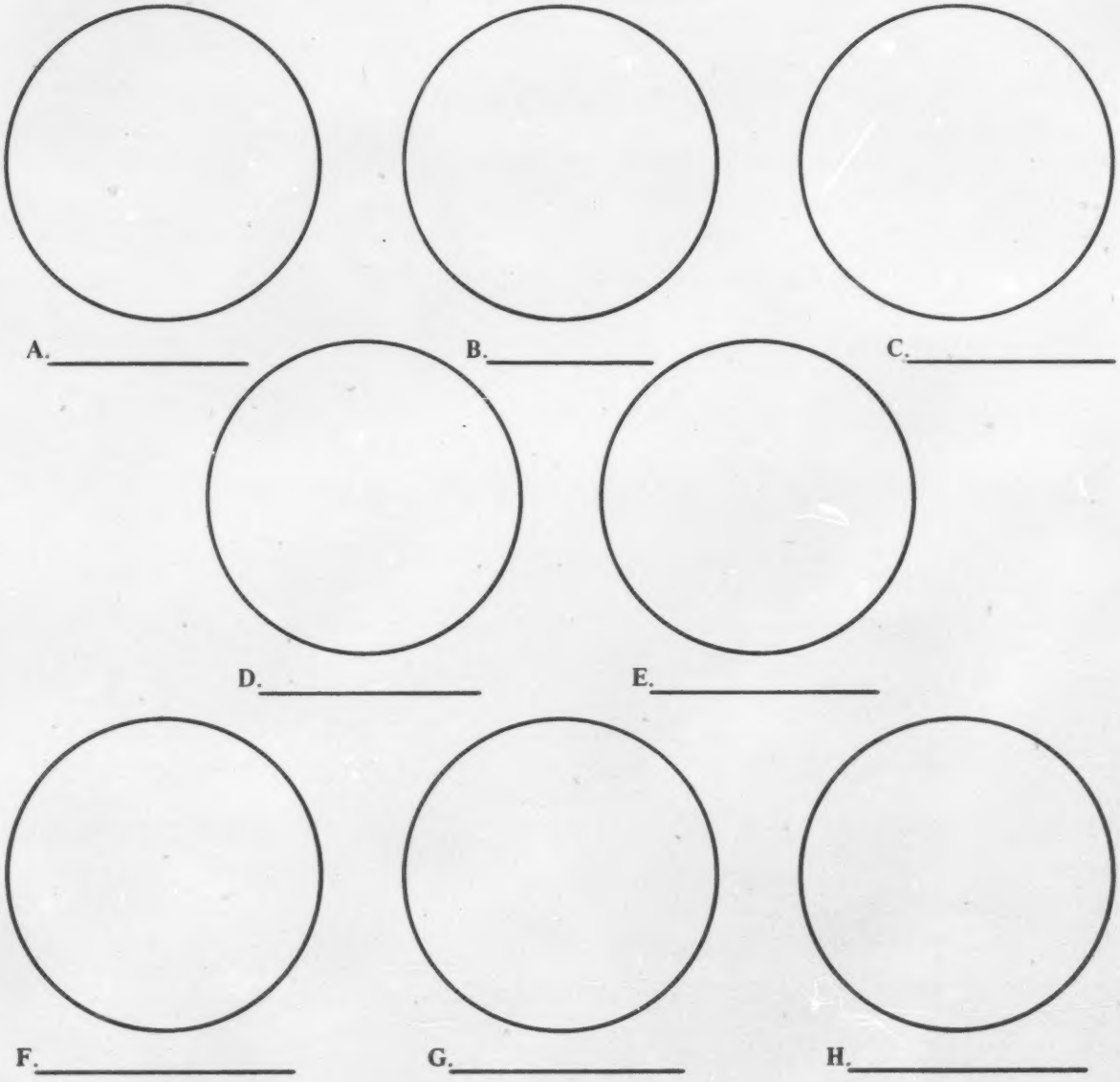
5. Using the yarn needle as a shuttle, weave a plain weave sample. Try to keep a weft density equal to the warp density. Be careful to weave with an even tension and to maintain neat selvages.

6. Tape this sample to a notebook page and label it with appropriate information..

Fiber Differentiation Using a Microscope

Use a good microscope to observe fiber differences. Observe small pieces of linen, cotton, wool. rayon, jute, nylon, acrilon and silk plus any other fibers you can find. Untwist the yarn, placing only one fluffed ply under the microscope.

In the circles below, draw how each fiber looks when magnified. Label each drawing with the fiber's name.



Shrinkage Laboratory

Use the following procedure as a separate experiment with each given fiber.

1. Measure and cut two one-yard lengths.
2. Using a scale of one-fourth to one, draw a line on your worksheet to represent the original length. Use a different color to represent each fiber.
3. Drop one length into the basin containing room-temperature water.
4. Put the other length into boiling water.
5. Let the yarns soak five minutes.
6. Prepare a label for each yarn.
7. Remove each yarn with tongs, allowing it to drip over the water container, and then press it between paper towels to remove excess moisture.
8. Hang each yarn and its label by a clothespin on the drying line.
9. When the yarn is thoroughly dry, probably the next day, remove it from the line and measure its length. Record this finding with an appropriate line on your worksheet.
10. Describe any changes in appearance in writing on your worksheet.

Problem for Written Discussion

The characteristic shrinkage pattern of a fiber influences use of a cloth made from that fiber, since cleaning as well as durability and appearance is often an important factor.

Imagine yourself as a textile designer and plan several appropriate ways you might suggest use of fabrics you have designed out of each of the tested fibers. You should also suggest care and cleaning.

Testing Fibers by Burning

In recent years, many important synthetic fibers have been developed. These fibers are often hard to distinguish, but formerly the flame test was a standard practice for identifying commonly used fibers.

Use the following procedure with each of the given fibers.

Procedure

1. Cut a four-inch length.
2. Taking utmost care, hold the yarn with tongs so that one end is placed into candle flame.
3. Remove the yarn from the candle flame immediately and blow out the fire if the yarn has ignited.

4. On your worksheet, describe the ignition pattern. Did the yarn catch on fire readily? Did it blaze up or smoulder?

5. On your worksheet, describe the smell of the burnt yarn.

6. Observe carefully the burnt end and describe its ash or resulting bead.

Problem for Written Discussion

Can you think of any practical application of knowledge gained in this experiment?

Fiber Identification Absorption Experiment

Despite the increase in production of synthetic yarns, many people still prefer 100 percent cotton tee shirts and heavy-duty work clothes because cotton is very absorbent and therefore cool, since evaporation of perspiration acts as refrigeration for the body.

Linen is more absorbent than cotton, but is generally more expensive and wrinkles more readily and permanently.

Knowing that linen is more absorbent than cotton and that cotton is more absorbent than most synthetics, use the following procedure to make absorption experiments with each of the given fabric swatches.

Procedure

1. Take a swatch from each of the provided groups.

2. Place the swatches in a carefully determined order (your own plan) on a piece of waxed paper.

3. Put one drop of ink on the center of each swatch and observe what happens.

4. Allow the swatches to dry.

5. Tape the swatches to a labelled notebook page.

6. Identify the swatches you believe to be linen and 100 percent cotton.

7. Write any additional speculations you may have about the identity of other swatches.

8. Check your guesses.

Fiber Elasticity Experiment

Procedure

1. Measure exactly one yard each of wool, linen, jute, acrilon, nylon and rayon yarns of similar size and twist. (Add any additional fibers available.)

2. Group the yarns into one bunch by carefully pulling the yarns even at one end. Tie this end into a knot.

3. Tie the knotted end around a firmly-secured projection such as the knob of a closed door.

4. Choose a partner to help you with the rest of the experiment.

5. Have your partner pull each yarn to its fullest length. Try to avoid stretching a yarn till it breaks but do pull it as far as you think it will stand. If a yarn should break, record that fact.

6. Measure and record the stretched length of each yarn.

7. After measuring each stretched yarn, re-combine the yarns into one bundle and pull it taut. Record your observations about length differences noticed at this point.

8. Observe the appearance of each individual yarn after it has been allowed to relax. Record any changes you see.

9. Discuss in writing possible practical applications of the findings from this experiment. (One hint: Can you foresee any problem in using any particular combination of yarns in a weaving form in which the warp must be held in consistent tension?)

WEAVING VOCABULARY

basket weave–a weave in which alternate pairs of yarns are covered.
beater–the part of a loom that holds the reed and beats weft into place.
bobbin–a device on which thread is wound to be used as weft.
butterfly–an arrangement of yarn made on the hand to use as a shuttle substitute when a small amount of yarn is desired.
castle–the central main structure of a loom that houses the harnesses.
cloth beam–front beam of a loom on which fabric is wound and stored as it is woven.
count–the number of threads per inch in a fabric.
dent–the spaces in a reed through which warp ends are threaded. Reeds come in different sizes determined by the number of dents per inch; *i.e.*, No. 8 Reed has eight dents per inch.
density–the quality of compactness of threads in a fabric; sometimes the number of yarns per inch in a warp.
draft–diagram of a weave as used by a fabric designer (weave draft); or plan for threading a loom or for arranging the order in which harnesses are raised (threading draft and chain draft).
dressing–term (verb) applied to the process of putting the warp on a loom.
end–an individual warp yarn.
fabric–cloth or textile.
fiber–any material capable of being spun into yarn.
frame loom–a primitive upright loom structured primarily from four poles fastened together to make a frame around which the warp is wound vertically; also, a simple loom used by contemporary handweavers for small projects that do not require complicated shed patterns.
graph–a diagram that symbolically represents a procedure or finding.
graph paper–special paper marked off in even squares to facilitate graphmarking.
harness–the frame that holds heddles on a loom. The lifting or lowering of a harness creates a shed; thus the greater the number of harnesses, the greater the weave pattern variations possible.
heddle–a string, wire or flat metal shaft having an eye through which a warp end is threaded on a loom so that a shed can be effected.
Inkle loom–a simple loom on which a tape or narrow band such as a belt is woven around pegs.
loom–a piece of equipment on which textiles are produced by weaving. It must hold warp yarns in sequence and under tension to provide for the insertion of weft.
plain weave–also called tabby; the most basic weave in which alternate yarns are covered.

ply–one of the strands twisted together to form a *plied* yarn which is stronger than an individual strand.
raddle–a spreader used in dressing a loom to hold warp in the desired width and density.
ratchet–a device (wheel with teeth) for maintaining tension of material on a loom beam.
reed–a comblike device held by the beater to space and hold warp in the desired placement.
reed hook–a small tool used in dressing the loom, especially in threading the reed.
rya–a knot used to form and hold pile as in a rug.
selvage–lengthwise edge of cloth in which the warp yarns are often grouped tightly.
shed–the opening in between layers of warp yarns which allows the insertion of weft.
shot–also called pick; a single passage of weft yarn through the warp.
shuttle–a device which holds weft yarn to facilitate its passage through the warp.
singles–yarn that is not plied, not usually strong enough to use as warp.
spin–to twist and draw out a fiber so that thread is produced.
spindle–a small device used in spinning.
strip weaving–primitive weaving still produced in parts of South America and West Africa. In West Africa it is known also as men's weave because women weavers there use a different technique. It consists of narrow bands which are stitched together to form functional cloths.
sword–a long, smooth stick used to clear the shed and beat in the weft on a frame loom weaving.
synthetic fiber–fiber made by man by chemical processes; nylon, rayon, acrilon are examples.
tapestry–a weft-faced textile built of small areas of different-colored yarns.
tension–the degree of tightness to which a warp is stretched on a loom.
treadle–a foot pedal that lowers or raises a harness when pressed.
twill–a basic weave having a diagonal rib.
warp–lengthwise threads in woven goods; also the yarn group prepared by count and pattern to attach to the loom for weaving.
warp beam–the rotating back beam of a loom for storing unwoven warp.
warp-face–weaving in which warp hides the weft (as in Inkle belts).
weave–the pattern determined in a fabric by the way the weft and warp yarns interlace; also (verb), to produce a weaving.
weaving–the process or the product of textile production by the interlacing of two sets called the warp and the weft.
weft–also called filling and woof; the crosswise element in weaving.
weft-face–weaving in which weft yarns hide the warp (as in flat tapestry pieces such as Navajo rugs).
yarn–thread used in weaving which is usually larger than thread used for sewing.

WEAVING-RELATED JOB OPPORTUNITIES

Designing
Custom weaving for fashion fabrics. Textile mill designing. Interior decorating. Consulting for architects and car manufacturers.

Teaching
In public schools, universities, colleges, art schools. Instructing at camps. Doing occupational therapy in hospitals, community centers. Conducting lecture-demonstrations for department stores, manufacturers. Serving as Master Weaver with apprentices. Teaching private students.

Professional Weaving
Studio production alone or with a group. Executing commissions for architects, interior designers. Weaving fashion fabrics. Weaving own designs for sale and for own personal use.

Selling
Agent to loom manufacturers. Seller of weaving supplies through department store or craft shop. Manager of handcrafts sales shop or fairs.

Promoting
Writing or photographing for magazines and books. Lecturing. Working as T.V. program director. Developing craft fairs, exhibitions, gallery and museum shows.

Managing
Directing craft guilds and fairs. Managing trade magazines. Managing weaving workshops, cooperative studios, textile industries.

Manufacturing
Working in any of numerous operations of a textile mill.

SUGGESTED RESOURCES

Books
Atwater, *American Handweaving.* Macmillian. (Chapter I).
Bennett and Bighorse, *Working With the Wool.* Northland Press. (Preface and Introduction).
Horwitz, *Mountain People, Mountain Crafts.* Lippincott. (Chapter VII).
Marien, *Off the Loom.* Viking. ("How It Started").
Tunis, *Colonial Living.* World. "Wool Production" through "Clothing."
Wilson, *Weaving is Fun.* Van Nostrand Reinhold. ("From Source to Yarn to Fabric").
Znamierowski, *Step-by-Step Weaving.* Golden Press. (Introduction).

Magazines
Arizona Highways July, 1974. "Three Centuries of Navajo Weaving."
Crafts Horizons. Membership publication for American Craftsmen's Council. (Any issue).
Handweaver and Craftsman. Membership publication for Handweavers Guild of America. (Any issue).
Spindle, Shuttle and Dyepot. Membership publication for Handweavers Guild of America. (Any issue).

Encyclopedias
Use *all* available encyclopedias, checking "Textiles," "Tapestry," "Spinning," "Weaving," "Cotton," "Fibers," "Silk," "Wool," etc. *Golden Encyclopedia* is good for slow readers.

Special Publications
Backstrap Weaving. Agriculture Extension Bulletin No. 362-1970.
Card Loom Weaving. Dryad Leaflet 100.
Textiles. Boy Scouts of America Merit Badge Series.

Films
"Cloth: Fiber to Fabric." Shows how natural and synthetic fibers are produced, spun and woven. Encyclopaedia Britannica Educational Corporation, Georgia Classroom Teaching Films #4619.
"Homespun." Beautiful picturing of 70-year-old Swedish-American woman shearing her goat, spinning and vegetable-dying the wool and weaving it into cloth on her handmade loom. Good introduction to course. International Films Bureau. Georgia Classroom Teaching Films #4820.
"Loom." Shows cloth production by early American pioneers. Arthur Barr Productions. Georgia Classroom Teaching Films #1153.

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Slides

"Fabrics International." Your Portable Museum Kit A-9. 159 contemporary and traditional fabrics ranging from fine silks and woolens to paper and plastics materials. $5.00 rental fee for two weeks. American Craftsmen's Council Research and Educational Department, 44 W. 53rd Street, New York 10019.